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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Digital Audio Broadcasting Systems	)	MM Docket No. 99-325
And Their Impact On the Terrestrial Radio	)	
Broadcast Service.	)	

COMMENTS OF USA DIGITAL RADIO, INC.

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EXECUTIVE SUMMARY

USA Digital Radio, Inc.'s comments in this proceeding support the Commission's desire to upgrade existing AM and FM radio through the introduction of Digital Audio Broadcasting ("DAB"). The Commission should use this proceeding to accomplish a number of goals. The Commission should issue a Report and Order concluding that In-Band On-Channel ("IBOC") technology is the best means of implementing DAB in the United States and that a transmission standard should be established. The current record amply supports such a determination. At the same time, the Commission should release a Further Notice requesting the information necessary to establish a technical record for selecting a IBOC DAB transmission standard. USADR provides additional guidance herein on the type of information needed and proposes a schedule for collection of this information. In order to ensure timely introduction of this innovative technology, the Commission should allow for collection of information and designation of an IBOC DAB standard by the end of this year. This goal can be accomplished if the Commission issues a DAB Report and Order and Further Notice by June 1, 2000. USADR believes that would leave sufficient time to collect additional information and establish a final standard by year end.

USADR's comments also endorse the Commission's policy goals and tentative selection criteria for DAB. The Commission has correctly identified the need both to protect the integrity of existing analog AM and FM and to encourage the introduction of new and improved service made possible by DAB. This goal must serve as the foundation for Commission evaluation of DAB.

The Commission's proposed evaluation criteria provide a means for a comprehensive assessment of DAB systems. USADR endorses the Commission's determination that DAB must increase audio quality to provide near-CD quality sound on FM stations and FM-like sound on AM stations. USADR believes the Commission also should emphasize enhanced robustness to ensure

greatly increased resistance to multipath interference, noise and fading. The Commission correctly has determined DAB must minimize interference to existing analog radio, operate in a spectrally efficient manner, and provide capacity for new services. USADR believes, however, it is critical for DAB's success to ensure all existing broadcasters can be accommodated in an efficient way. USADR believes IBOC is the best and only means to satisfy these criteria.

USADR endorses the IBOC model rather than a new spectrum model for implementing DAB. A new spectrum model would be inefficient, unnecessarily complicated and would result in a significant delay in the transition of terrestrial radio to a digital service. In fact, the deficiencies of a new spectrum approach only serve to reinforce the soundness of the IBOC approach. IBOC was developed to facilitate an efficient and timely transition to DAB and to avoid the regulatory, administrative or commercial disruption inherent in the use of new spectrum.

In the Notice, the Commission asks whether it should seek to identify new spectrum for DAB in order to avoid some of the compromises intrinsic to an in-band approach. The Notice raises as an example of a new spectrum approach the use of six megahertz of spectrum currently allocated for Television Channel 6 at 82-88 MHz. As is demonstrated in these comments, any new spectrum approach, and in particular the proposed use of TV Channel 6, most likely will result in a failure to introduce DAB.

USADR supports the tentative conclusion in the Notice that the Commission should be involved in the establishment of an IBOC transmission standard. USADR also urges the Commission to recognize both prongs of its test for mandating a standard are satisfied in this case. Recognizing the need for a transmission standard and establishing procedures for developing that standard at this point will help ensure a timely introduction of DAB.

The Commission should establish a process for collecting additional information to set a standard for IBOC by the end of this year. USADR urges the Commission to establish a process for collection of data using the following timeline:

- June 1, 2000 — FCC Adopts R&O establishing IBOC as means to implement DAB, adopts evaluation criteria, issues call for submission of system and test data and releases Further Notice on implementation issues.
- September 1, 2000 — Deadline for proponents to submit system descriptions and test results to Commission.
- December 31, 2000 — FCC adopts Second R&O designating IBOC transmission standard

The September 1, 2000 submission should include a full system description of the final IBOC system and a report of comprehensive laboratory and field testing by a qualified independent entity. USADR encourages the Commission to endorse use of the existing NRSC guidelines for these tests.

USADR encourages the Commission to expedite its consideration of these issues and to move forward to implement IBOC DAB.

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COMMENTS OF USA DIGITAL RADIO, INC.

USA Digital Radio, Inc. ("USADR"), by its attorneys, hereby submits these comments in response to the Commission's Notice of Proposed Rulemaking in the above-referenced proceeding.[1] Terrestrial AM and FM radio represent one of the most important communications media in this country. USADR supports the Commission's desire to upgrade the quality and capabilities of existing AM and FM radio through the introduction of Digital Audio Broadcasting ("DAB"). The Notice establishes the necessary framework to balance the options for upgrading analog radio to digital as the best means to ensure the long-term viability of this service. USADR encourages the Commission to expedite its consideration of DAB and to move forward with DAB implementation.

As USADR demonstrates in greater detail herein, the Commission should use this proceeding to accomplish a number of goals. The Commission should issue a Report and Order concluding that In-Band On-Channel ("IBOC") technology is the best means of implementing DAB in the United States and that a transmission standard is required. The current record amply supports such a determination. At the same time, the Commission should release a Further Notice requesting

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1 *Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Service*, MM Docket No. 99-325, *Notice of Proposed Rulemaking* (rel. Nov. 1, 1999) ("Notice"). The Notice established a comment date 75 days after publication in the Federal Register. The Notice was published in the Federal Register on November 9, 1999, 64 Fed. Reg. 216, thereby establishing January 24, 2000 as the date for filing comments in this proceeding.

information necessary to establish an IBOC DAB transmission standard. USADR provides additional guidance herein on the type of information needed and proposes a schedule for collection of this information. In order to ensure timely introduction of this innovative technology, the Commission should allow for collection of information and designation of an IBOC DAB standard by the end of this year. This goal can be accomplished if the Commission issues a DAB Report and Order and Further Notice by June 1, 2000. USADR believes that would leave sufficient time to collect additional information and establish a final standard by year end.

USADR's previous filings included technical information demonstrating the viability of its IBOC DAB technology. USADR is in the process of final system optimization and is confident independent testing being conducted on its behalf will demonstrate the USADR IBOC DAB system should be designated as the U.S. standard.

I. Introduction

USADR first conceived the idea of upgrading analog radio using an IBOC solution in 1991. Since that time, USADR has been the leader in the development of IBOC DAB for terrestrial radio. Over fifty world-class engineers and scientists are presently working on USADR's IBOC DAB system. The company holds thirty patents, with numerous pending patent applications covering broad aspects of IBOC DAB technology. USADR is working to develop and promote IBOC with a coalition of interests that includes broadcasters; transmitter, receiver and semiconductor manufacturers; and research centers in the United States and abroad. Over twenty-seven companies representing a broad spectrum of domestic and international businesses are investors in USADR. Fourteen of the nation's largest radio broadcasters, including the ten largest, are investors in USADR. These include ABC, AMFM, Bonneville, CBS, Citadel Communications, Clear Channel, Cox Radio, Cumulus Media, Emmis Communications, Entercom Communications, Hispanic

Broadcasting, Radio One, Saga Communications and the Sinclair Broadcast Group. Other investors in USADR are key industrial, media and financial companies such as Texas Instruments Ventures, Gannett and Allbritton Communications, and investment firms DB Capital Partners, ComVentures, Chase Capital Partners, Grotech Capital Partners, Flatiron Partners, H&Q Venture Associates, J&W Seligman, J.H. Whitney, Riggs Capital Partners, Williams, Jones & Associates and Waller Sutton Media Partners.

USADR has assembled a board of directors of prominent radio broadcasters and government regulatory and emerging technology experts, including Mel Karmazin of CBS, Jimmy de Castro of AMFM and Alfred Liggins of Radio One. USADR's broadcaster investors have coverage in 196 of the 270 Arbitron-rated markets, access to 200 million listeners and combined revenues accounting for 46% of the radio industry's total revenues. Other broadcasters representing more than 500 stations are participating in USADR's Early Adopter Station Enhancement ("EASE") programming. The EASE program provided at no cost and targeted at small and mid-size radio stations, offers to help broadcasters stay abreast of IBOC developments, provides station assessments about compatibility of equipment with USADR's system and distributes announcements of key milestones. Of these EASE participants, more than 35% come from non-Arbitron-rated markets.

USADR is building on this base and assembling the broad business coalition of manufacturers necessary to ensure radio's rapid transition to a digital future. USADR is working with Kenwood Corporation on development of IBOC receivers. Kenwood displayed its prototype of a USADR-compatible IBOC receiver at this year's Consumer Electronics Show. USADR has joint development programs underway with semiconductor manufacturers to produce IBOC capable chip sets. Texas Instruments ("TI"), the leading supplier of digital signal processor ("DSP") technology, and USADR are working closely to customize TI's technology for a reasonably priced

implementation of USADR's IBOC system. In addition, USADR recently announced a joint marketing and development agreement with Analog Devices ("ADI") to integrate IBOC software onto ADI's DSPs. USADR also has longstanding joint technology and marketing agreements with most radio broadcast transmission equipment manufacturers, including Andrew Passive Power, Broadcast Electronics, Continental Electronics, Energy-Onix, Nautel, Orban, QEI, Shively Labs, Jampro, and Telos/Cutting Edge. Each member of this growing coalition is developing IBOC transmission equipment and is coordinating with USADR strategies for the market launch of IBOC technology and associated products. Additionally, USADR is working with several development partners. Fraunhofer Institut für Integrierte Schaltungen (IIS) is customizing its internationally standardized Advanced Audio Coding ("AAC") codec for USADR's IBOC system. Xetron Corporation is leading USADR's AM field test efforts. Bittware has provided receiver/exciter processing boards for development test efforts.

Pursuant to an agreement recently announced between USADR and IBOC proponent Digital Radio Express ("DRE"), DRE has ceased development of its own IBOC system and will support efforts to commercialize USADR's system. The companies will cooperate in the development of USADR's IBOC DAB technology and the regulatory process required for its adoption in the United States. DRE will focus its business on data ventures, including specialized data applications for USADR's system.

USADR actively promotes IBOC technology and the USADR system domestically and abroad. USADR participates on U.S. delegations to numerous ITU and CITEL meetings addressing AM and FM broadcasting. USADR regularly briefs broadcasters and broadcasting associations in the United States on a state and national level, throughout South America and in Europe on the

progress of IBOC development. These efforts have yielded widespread domestic and international interest in and support for IBOC DAB.

USADR recently submitted to the National Radio Systems Committee ("NRSC") an interim report on USADR's ongoing laboratory and field test program.[2] That report summarizes the results of laboratory and field tests USADR conducted last year. USADR conducted those tests using numerous facilities including (i) USADR's DAB laboratory in Columbia, Maryland; (ii) digital radio laboratories of Xetron Corporation in Cincinnati, Ohio; (iii) the independent laboratory test bed established for the USADR system at the headquarters of the Advanced Television Technology Center ("ATTC") in Alexandria, Virginia;[3] (iv) WPOC-FM, Baltimore, Maryland; (v) WETA-FM, Washington, D.C.; and (vi) USADR's digital AM station in Cincinnati. The report documents the tremendous system development progress USADR has made over the last year.

USADR's test results demonstrate its system is an improvement over existing analog broadcasting. It provides improved audio quality and enhanced robustness even in the presence of multipath interference, noise and fading. The tests recorded a higher audio quality than that offered by existing analog broadcasting and unimpaired digital coverage extending to a point where existing analog service is degraded. Tests also confirmed the USADR system will not cause audible interference to either the host analog station using IBOC or co-channel and adjacent channel analog signals within a station's listening area. USADR's system optimization efforts and testing are ongoing. The results reported to the NRSC, however, demonstrate that IBOC is a significant

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[2] A copy of this report also was submitted to the Commission for inclusion in this docket. *See* Letter of Albert Shuldiner to Magalie Salas dated December 21, 1999.

[3] The ATTC is a private, non-profit corporation organized by members of the broadcasting and consumer products industries. The ATTC operates a state-of-the-art laboratory facility where it conducts extensive, fair and impartial testing of professional and consumer broadcast equipment.

upgrade to the existing analog service. Therefore, the Commission should endorse IBOC as the best means to implement DAB and should move forward to set an IBOC standard.

II. USADR Supports the DAB Policy Goals Articulated in the Notice

The Notice provides important details on the unique role terrestrial radio plays in our society. USADR agrees with the Commission that radio offers "unrivaled accessibility and [a] unique ability to provide local news, information and public service programming."[4] It cannot be denied that radio is an important part of most people's lives. Due to radio's unique role, it is critical that the Commission's decisions in this proceeding be based on a strong foundation of policy goals that are broadly applicable to terrestrial radio services and meet the needs of both radio listeners and broadcasters. USADR believes the Commission has achieved in the Notice an appropriate articulation of the two fundamental goals for DAB implementation: the need to protect the integrity of existing radio services and the desire to promote new and improved services for the public.

USADR is pleased the Commission has focused on the need to implement DAB as a means to protect and improve analog radio. USADR agrees it is imperative that the Commission support "a vibrant and vital terrestrial radio service for the public" and that all broadcasters be given the opportunity to provide DAB in order to fulfill this goal.[5] However, the Commission should define this policy with somewhat greater specificity. USADR has consistently encouraged the Commission to make an explicit finding that DAB must provide an upgrade for both AM and FM broadcasters.

USADR also endorses the Commission's tentative conclusions about the correct attributes which must be offered by any digital system. DAB must represent an improvement in service to the public if it is to have any appeal. This improvement must involve increased sound quality and

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4 Notice at 3.

5 *Id.* at 9.

enhanced robustness. USADR encourages the Commission to include the potential for new consumer services as an additional improvement DAB must provide. A viable system must be spectrum efficient and must minimize interference to analog services. Moreover, the upgrade to digital should not involve burdensome investment in new equipment and should protect the embedded base of receivers in use in this country. Minimizing costs for listeners and broadcasters will encourage acceptance of DAB. USADR believes this proceeding will demonstrate IBOC is the best means, and in fact the only means, to achieve these goals.

Because the Commission's analysis must closely consider the technical attributes of DAB systems, USADR believes the Commission should consider its policy goals in the context of the tradeoffs necessary to implement DAB. Any new technology involves a series of tradeoffs which impact system performance. In the case of DAB, the tradeoffs involve the essential elements of the system. DAB should be designed to address audio quality, robustness, coverage, spectral efficiency and new services. In order to do this, a certain amount of system capacity, in the form of bits, needs to be devoted to each element. For example, if more bits are devoted to enhance robustness through forward error correction, fewer bits remain to be dedicated for improved audio quality or new services. Similarly, higher power levels may increase coverage but may also result in a greater impact on compatibility with existing analog broadcasts. A desire for spectrum efficiency will drive a different set of tradeoffs. A wider signal transmits additional bits for more robustness, higher fidelity or new services. But bandwidth use is constrained by the need to minimize any impact on adjacent channel signals.

USADR believes these system tradeoffs have a direct impact on the evaluation criteria discussed below. USADR is optimizing its system to satisfy the dual policy goals of protecting analog and providing a compelling new digital service. USADR's discussion herein of the

Commission's evaluation criteria takes into account the tradeoffs USADR believes are necessary for DAB to succeed. USADR encourages the Commission to structure its policy goals and evaluation criteria based on the tradeoffs USADR highlights below in order to promote an optimized DAB system.

III. The Commission Has Selected Appropriate Criteria for Evaluating DAB Systems

The Commission's articulated evaluation criteria will promote a comprehensive assessment of the attributes of DAB systems. The proposed criteria are compatible with both the criteria the NRSC has announced it will apply to its analysis of IBOC DAB[6] and those adopted by the International Telecommunication Union ("ITU") for its analysis of digital audio systems operating below 30 MHz.[7] USADR provides below specific comments on the proposed criteria.

A. Enhanced Fidelity/Robustness

Enhanced audio fidelity and robustness are the core goals of DAB. Even though any DAB system will have limitations on the amount of available bandwidth, the system design must favor improved audio fidelity and enhanced robustness of the digital signal. USADR agrees that an AM system should provide FM-like quality and an FM system should provide near-CD quality sound. USADR's studies indicate these levels will address listener expectations and desire for improved audio fidelity.

Enhanced robustness of the signal must accompany this improved audio fidelity. USADR's field tests have demonstrated enhanced robustness has as much impact on the listening experience as the improvement in audio fidelity DAB offers. A robust system should greatly increase resistance

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6 *See* National Radio Systems Committee DAB Subcommittee, In-band/On-channel (IBOC) Digital Audio Broadcasting (DAB) System Evaluation Guidelines, adopted April 17, 1999, revised May 25, 1999.

7 *See* International Telecommunications Union, Telecommunication Bureau, Circular Letter 10/LCCE/39 dated September 29, 1999 at Annex 3.

to multipath interference, noise and fading. For an FM system, enhanced multipath resistance can translate into unimpaired, near-CD quality sound in dense urban areas where existing analog broadcasts are severely degraded. Robustness can ensure AM coverage under bridges, overhead signs and power lines where analog signals are typically lost. USADR is confident IBOC will provide these enhancements and believes they should be required for any DAB system the Commission endorses.

B. Compatibility

USADR agrees that any DAB system must "minimize interference to reception of host and adjacent-channel analog signals."[8] This level of compatibility is essential for listeners and broadcasters to embrace DAB. Although IBOC systems will introduce new energy into the AM and FM bands, IBOC avoids harmful interference. It is able to minimize the impact on existing analog broadcasts and to ensure a smooth transition to digital broadcasts. USADR has been on the air for approximately 1,000 hours conducting FM system tests using WJFK-FM, a station with some of the worst first adjacent channel interference issues in the country, without a single listener complaint to WJFK's short-spaced first adjacent stations.

USADR also believes compatibility with existing FM subcarriers is a valid area for Commission consideration. Consumer acceptance of DAB may be diminished if subcarriers are unduly impacted. USADR's field testing has shown IBOC is compatible with subcarriers. USADR's tests conducted using WETA-FM over a period of several months resulted in no complaints from users of WETA's 67 kHz or 57 kHz subcarriers. 92 kHz subcarriers are somewhat more fragile, even in the existing analog environment, due to their placement at a distance from the center channel and may present a greater challenge. USADR has not had an opportunity to field test

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[8] Notice at 11.

its system on a station using a 92 kHz subcarrier. However, USADR's market research indicates the vast majority of subcarriers operate at 57 kHz or 67 kHz. Therefore, compatibility with the 92 kHz subcarrier should not be an area of major concern for DAB implementation.[9]

C. Spectrum Efficiency

Again, USADR agrees spectrum efficiency is an important evaluation criteria for DAB systems. In the Notice, however, the Commission has not placed sufficient emphasis on the intrinsic spectrum efficiency IBOC offers. IBOC's ability to upgrade AM and FM radio to digital without new spectrum is an extremely efficient use of the existing radio broadcast bands and should not be discounted.

The USADR system incorporates additional techniques which promote efficient use of spectrum. Audio compression minimizes the bandwidth required to achieve desired audio quality. FEC coding and interleaving techniques facilitate robust performance, even when interference corrupts a portion of the signal. Additionally, pulse shaping of the OFDM symbols helps reduce adjacent channel interference to existing analog and future digital stations. These enhancements which digital technology is able to offer are necessary for the digital signal to survive in the heavily congested AM and FM bands.

USADR is concerned about the Commission's discussion of the impact of receiver technology on spectrum efficiency. It is correct that improved receiver designs have enhanced resistance to multipath and other interference. It is equally true that IBOC receivers should include many of these enhancements to protect the new digital signal as well as existing analog broadcasts.

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[9] The Notice also seeks comment on the compatibility of DAB and proposed Low Power FM ("LPFM") stations. At its January 20, 2000 Open Meeting, however, the Commission adopted a Report and Order introducing an LPFM service. In light of this intervening action, USADR believes it would be inappropriate to comment on this compatibility issue until the details of the technical parameters of the LPFM service are made available.

Nonetheless, it is unlikely that IBOC technology or new receiver designs will permit "more intensive spectrum utilization"[10] beyond that of introducing the digital signal. The bulk of the efficiencies IBOC provides are dedicated to protecting the digital carriers in the harsh interference environment of the analog AM and FM bands. USADR believes, when balancing the Commission's criteria, it is appropriate to promote a robust digital system which is able to enhance audio quality and introduce new consumer services rather than a desire for even more intensive utilization of the broadcast bands. Moreover, it would be premature at this point or in the context of this proceeding to consider more intensive use of the spectrum which may be possible in an all-digital environment.

D. Flexibility/Auxiliary Capacity

USADR encourages the Commission to define flexibility somewhat more broadly than it is used in the Notice. DAB should provide listeners and broadcasters with flexibility concerning digital implementation. The public interest will be best served by a system which offers consumers flexibility to upgrade to digital based on their own schedule. Similarly, the system should offer broadcasters flexibility to control their station upgrades. This flexibility should be achieved without sacrificing improved audio quality or robustness and without degrading compatibility. IBOC incorporates this flexibility to offer complete listener and broadcaster choice.

Flexibility also involves the introduction of new auxiliary services as the Notice discusses. USADR agrees the Commission should be "committed to encouraging a DAB system design that would permit the flexible and dynamic development of new broadcast and non-broadcast services and features and allow broadcasters to realize specific service opportunities."[11] The public interest will be best served by using DAB to provide new services for consumers.

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[10] Notice at 12.

[11] *Id.* at 13.

USADR is concerned, however, about the Commission's tentative conclusion that "ancillary services must not technically impair the reception of DAB programming."[12] USADR encourages the Commission to clarify that it does not intend to restrict flexibility. Broadcasters may not have a uniform approach to IBOC implementation, and listeners may have different expectations depending on the format of the station they listen to. For example, music format stations are likely to be the most concerned about using IBOC to improve audio quality. Nonetheless, there may be stations, due to a particularly challenging interference environment, that choose to optimize the settings of their IBOC system to emphasize robustness over audio quality. The Commission should expect the DAB system to accommodate these choices. Similarly, all-talk format stations may have different upgrade objectives than music format stations. Talk radio stations may not want to devote digital capacity to improve audio quality. They may choose to increase the system capacity dedicated to auxiliary services and retain lower audio fidelity. The Commission's rules should provide for this level of flexibility and leave it to the marketplace to resolve these issues.[13]

E. Extensibility

The Notice correctly concludes that "a DAB system design also must be adaptable to future technological advances."[14] Consumers will demand upgrades to the DAB system as technology permits further enhancement. It would defeat the public interest to inhibit future development and innovation of DAB technology. USADR agrees the Commission should include this as a relevant criteria for assessing DAB systems.

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12 *Id.*

13 *See Advanced Television Systems and Their Impact upon the Existing Television Broadcast Service*, 12 FCC Rcd 12809 (1997) at ¶ 41 (providing television broadcasters with flexibility to select HDTV or a different programming level within the overall DTV standard).

14 Notice at 13.

F. Accommodation of Existing Broadcasters

USADR strongly supports the Commission's tentative conclusion that "any DAB system should, to the maximum extent possible, accommodate all existing broadcasters that desire to initiate DAB system transmissions."[15] This must hold true for both large and small broadcasters. Radio provides vital services which must be maintained and enhanced through the upgrade to digital. USADR has seen firsthand the strong support for DAB among independent broadcasters. There has been widespread interest in the EASE program and regular responses to USADR's newsletter and outreach programs. The Commission should ensure this interest in DAB is addressed in this proceeding. Moreover, the Commission should recognize the significant investment large and small broadcasters have made to enable them to serve the public. DAB should acknowledge that investment by providing an upgrade for all existing stations. This should include both AM and FM radio to ensure the public receives the maximum benefit from IBOC technology.[16] At the same time, USADR agrees it is unnecessary for the Commission to address the question of AM and FM parity. The relative economic position of AM and FM broadcasters is a complex topic unrelated to IBOC implementation and does not need to be considered in this proceeding.

G. Coverage

USADR disagrees with the Commission's tentative conclusions concerning coverage of DAB systems. The public interest would be best served if the Commission looks at realistic listening patterns rather than concentrating on protection contours. USADR believes this criteria should be used to evaluate a system's ability to maximize high quality coverage. The Commission

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15 *Id.* at 14.

16 As is discussed in greater detail below, the Commission's proposal to use TV Channel 6 for DAB would not allow for the accommodation of all existing AM and FM broadcasters.

should not limit itself to an assessment of "digital" coverage. Rather, it should look to the system's ability to maximize the area of improved audio and enhanced robustness. Emphasizing this aspect of coverage will encourage systems to make the appropriate tradeoffs to maintain a balance between coverage and compatibility. The system goal should be maximized high quality coverage without causing harmful interference to existing analog signals.

An analysis of coverage can be conducted without consideration of the current protected service contours for analog AM and FM. USADR has not advocated a change in existing protected contours nor does it see any reason for a digital protected contour. USADR anticipates stations will continue to be protected only within their existing contours. At the same time, USADR encourages the Commission to consider a system's ability to maximize high quality coverage without regard to protection contours. USADR is optimizing its system to maximize coverage without causing harmful interference. The USADR system provides the highest quality audio throughout its area of digital coverage so it does not need to address concerns about low quality digital service. At the same time, USADR's system incorporates blend to analog to ensure coverage will always extend as far as existing analog even where there is an earlier failure of digital coverage.

H. Implementation Cost

The Notice correctly emphasizes the impact of implementation cost on the acceptance of IBOC. Lower implementation costs will encourage more rapid upgrades by consumers and broadcasters. USADR consistently has advocated for an IBOC transmission standard to provide certainty to the marketplace. This will help reduce equipment costs by ensuring manufacturers do not make investments in technology which ultimately will not be useful. USADR encourages the Commission to take account of both hardware costs and intangible costs, such as listener disruption and confusion, when considering this evaluation criteria.

IBOC is designed to minimize many of the relevant costs. IBOC allows broadcasters to maintain much of their existing equipment. USADR is working closely with transmitter, receiver and chip manufacturers to analyze the most cost effective means of implementing IBOC to ensure the lowest possible cost structure for the public. At the same time IBOC minimizes intangible costs by supporting existing listener behavior and current station channel positions.

IV. The Commission Should Adopt the IBOC Model

USADR strongly supports the Commission's tentative conclusions about the merits of IBOC and the benefits of using an IBOC model for DAB.[17] IBOC satisfies the Commission's policy goals and advances the public interest. It requires no new spectrum and provides a frequency efficient means to upgrade analog. IBOC can offer increased audio fidelity for AM and FM listeners as well as enhanced robustness of the signal. This can be achieved without harmful interference to host or adjacent channel users. USADR's test report demonstrates the viability of IBOC technology and its ability to satisfy the Commission's goals. It is appropriate for the Commission to endorse immediately IBOC as the means to implement DAB in the United States.

USADR does not agree, however, that IBOC raises spectrum efficiency concerns or that adoption of IBOC would change the Commission's spectrum assignment policies.[18] The Commission's discussion of this issue in the Notice is premised on the notion that AM and FM stations only use 10 kHz and 200 kHz, respectively, of spectrum. In fact, the Commission's rules provide for both AM and FM stations to use a much wider bandwidth.[19] The FCC's "emissions masks" for both analog AM and FM already provide for attenuated use of the sidebands. In essence,

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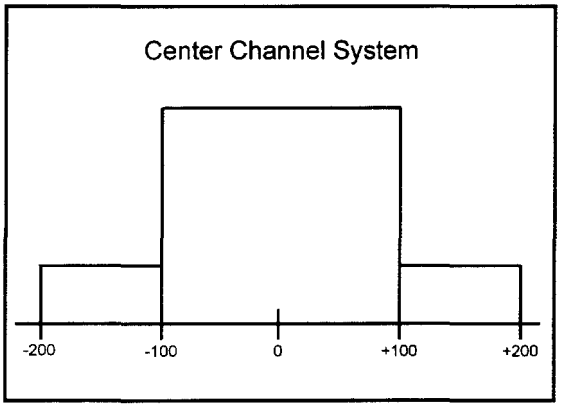
17 Notice at ¶ 37.

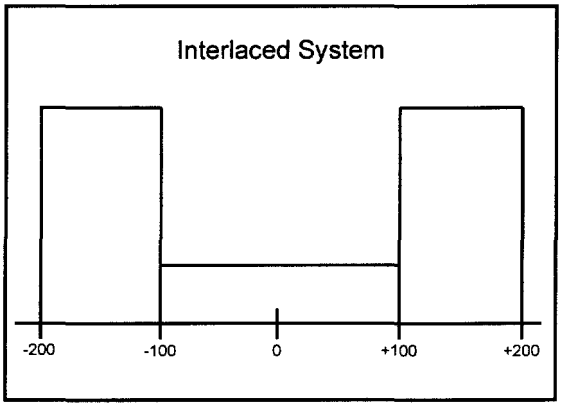
18 *Id.* at ¶ 38.

analog systems use these sidebands as a "guard band" against interference. This effectively precludes other use of the sideband spectrum.

IBOC DAB simply employs digital technology to put this spectrum in the sidebands to good use. IBOC does not use spectrum outside the existing analog mask, so its is incorrect to conclude IBOC systems use additional bandwidth. In fact, digital technology allows USADR to ensure the IBOC system operates within the existing mask to reduce the potential for interference.

It is important to note that the choice between use of sidebands or a center channel approach has no impact on bandwidth use. The USADR system operating in an all-digital mode places the main digital carriers in the sidebands with lower level digital carriers used for auxiliary services placed in the center channel. A system which places the main digital carriers in the center channel moves the auxiliary services carriers to the sidebands. As is illustrated in the following figures, the net impact on bandwidth, however, does not change.





As a result, with either system, there will be no spectrum to return at the end of the hybrid period.

USADR also disagrees with the Commission's assessment of the flexibility a sideband system offers. The USADR hybrid system inserts digital sidebands at either side of the analog

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[19] *See* 47 C.F.R. §§ 73.44 and 73.318. Section 73.44(b) authorizes analog AM stations to operate 10.2 kHz on either side of the Center carrier for a total of approximately 20 kHz.

channel. At any time the broadcaster can delete the analog signal and rely solely on the digital sidebands operating at the power level established for hybrid operations. Similarly, the broadcaster has the flexibility to maintain the analog signal and hybrid mode digital sidebands in perpetuity. Finally, the broadcaster will be able, when authorized, to upgrade to the all-digital system by removing the analog signal and enhancing the digital sidebands. Contrary to the Commission's discussion in the Notice, the USADR system will support all these configurations, thus enhancing IBOC's goal of increased flexibility and choice.

The record in this proceeding contains ample evidence of the benefits of IBOC. It protects existing analog broadcasting at the same time that it offers increased audio fidelity, enhanced robustness and new consumer services. IBOC offers spectrum efficiency, flexibility for listeners and broadcasters, an ability to accommodate all AM and FM stations and low implementation costs. The record contains ample evidence of the technical viability of IBOC and broad support for this important upgrade of analog AM and FM. USADR encourages the Commission to endorse IBOC and to move forward toward designation of an IBOC standard.

V. The Commission Has Misconstrued the Transition Issues IBOC Presents

The Notice misstates USADR's views on the best means for structuring the transition from hybrid broadcasting to an all-digital environment. Contrary to the description contained in the Notice, the USADR system will provide broadcasters with the flexibility to decide when to upgrade from analog to hybrid broadcasting and the technical capacity to upgrade from hybrid to all-digital at an appropriate time. USADR believes the decision to upgrade from analog to hybrid should and will be driven by market forces. But any decision to upgrade to an all-digital configuration which harms analog should occur only at such time as the Commission determines that the penetration levels of IBOC receivers is sufficiently high that the protection afforded to analog receivers by the

hybrid mode of operation is no longer necessary or appropriate. That decision will be driven by market forces and social consideration which make it premature to establish a firm timeline at this point.

USADR consistently has advocated that the conversion to DAB must be based on market forces. Thus, USADR strongly believes the Commission must require that broadcasters protect analog transmissions until the percentage of digital receivers in the marketplace is so high that few listeners are dependent on analog broadcasts. At that point, any interference from adjacent channel all-digital transmission to analog radio would have a negligible impact on listeners. Listeners and broadcasters will resist the implementation of DAB if it adversely impacts analog reception for a large number of listeners who have not upgraded to digital. USADR's Petition offered evidence that it would take market forces at least 12 years to produce sufficient penetration of digital receivers before an adverse effect on analog would have little overall impact on listeners. That 12 year figure represented only an estimate, based on equipment replacement cycles, of when an impairment of analog broadcasting would no longer impact most listeners. USADR does not advocate that as a fixed time frame for eliminating analog protection nor does it advocate any sunset of analog service.[20] Rather, USADR's technology will support analog broadcasts, even after the transition to all-digital broadcasting.[21]

The USADR system permits the introduction of DAB in the hybrid mode without adversely affecting existing analog signals by placing the digital signal in low level carriers on either side of

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20 Petition for Rulemaking of USA Digital Radio, RM-9395 (dated Oct. 8, 1998) at 89. ("Specifically, there is no need for the Commission to establish an end of service date for analog radio. An analog 'sunset' is unnecessary because the IBOC DAB signal will occupy the existing analog radio frequency, thereby eliminating the need to reclaim unused analog spectrum.").

21 *Id.* at 20. ("USADR's system has been engineered to permit listeners and broadcasters to upgrade to digital at their own pace. Upgrade decisions can be based on the economic needs of local stations and local listener demand without the threat of abrupt disruptions in local service.").

the analog signal This provides broadcasters the flexibility to upgrade to hybrid broadcasting at any time without the need to coordinate with other broadcasters. In the all-digital mode, however, the analog signal is eliminated and the digital carriers are enhanced to increase the coverage and performance of the DAB system. This enhancement of the digital sidebands in the all-digital mode, however, may have an increased impact on any remaining analog signals of first adjacent stations.

In order to address this issue of first adjacent interference, USADR proposed in its Petition that the Commission restrict broadcasters from enhancing the digital sidebands until such time as consumer acceptance of IBOC DAB receivers has reached a point when there will be few analog receivers in use. Although USADR provided an estimate for the time when that situation might occur, market forces alone will determine the optimal transition period. In order to facilitate this transition, USADR advocates that the Commission track the penetration rates for digital transmissions and digital receivers. When the Commission determines there is a sufficient penetration rate of receivers among listeners, the Commission should authorize broadcasters to enhance the digital sidebands in the all-digital mode. This approach would be consistent with the Commission's approach for digital television. In that case, the Commission has mandated the review of digital TV progress every two years.[22] The Commission recognized these periodic reviews would allow the Commission to "address any new issues raised by technological developments, necessary alterations in our rules, or other changes necessitated by unforeseen circumstances."[23] A similar approach should be adopted for DAB.

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22 11 FCC Rcd 12856.

23 *Id.*

VI. A New Spectrum Model for Implementing DAB Cannot Substitute for IBOC

A new spectrum model for implementing DAB would be inefficient, unnecessarily complicated and would result in a significant delay in the transition of terrestrial radio to a digital service. In fact, the deficiencies of a new spectrum approach only serve to reinforce the soundness of the IBOC approach. IBOC was developed to facilitate an efficient and timely transition to DAB and to avoid the regulatory, administrative or commercial disruption inherent in the use of new spectrum.

In the Notice, the Commission asks whether it should seek to identify new spectrum for DAB in order to avoid some of the compromises intrinsic to an in-band approach. The Notice raises as an example of a new spectrum approach the use of six megahertz of spectrum currently allocated for Television Channel 6 at 82-88 MHz. As is demonstrated below, any new spectrum approach, and in particular the proposed use of TV Channel 6, most likely will result in a failure to introduce DAB.

A. There is Insufficient New Spectrum Available for DAB

It is obvious that the first hurdle the Commission would need to overcome in order to pursue a new spectrum approach would be the identification of adequate, available spectrum. It is extremely unlikely that the Commission will be able to identify 20 MHz (or the equivalent) of new spectrum for DAB that would be necessary to afford all FM broadcasters an opportunity to transition to digital in the appropriate frequency range (VHF or UHF) that provides maximum benefits for mobile listeners. The Commission also would need to identify additional spectrum to accommodate AM broadcasters. In fact, the Notice only identifies 6 MHz as candidate spectrum. USADR submits any attempt to identify new spectrum will significantly delay the implementation of DAB. This

would only be further complicated if the new spectrum is even partially occupied, requiring relocation of incumbent users.

B. A New Spectrum Approach Would Increase Regulatory and Administrative Burdens

A new spectrum approach would require completion of a full spectrum reallocation proceeding before the Commission would be in a position to select a DAB standard. Without full details on the amount or location of the available spectrum, the Commission would not be able to make any reasoned decision about the structure of DAB. Recent experience in other areas would suggest the need to complete a spectrum reallocation proceeding before development of DAB service rules. This could add a significant delay to the development DAB rules and introduction of DAB in the United States.

A new spectrum approach would also have the potential to significantly tax the Commission's resources through the need to license service providers in the new spectrum. Even if the Commission intended to afford all AM and FM broadcasters opportunities to obtain licenses for DAB broadcasting using new spectrum, any such licensing process would be time consuming and would require expenditure of tremendous effort on the part of the Commission and existing licensees.

The Commission's recent experience with digital television highlights the complications of any attempt to replicate existing broadcasting relationships in a new frequency band. The allotment of digital television stations licenses has been a complicated and time consuming endeavor that has left some licensees less than satisfied. Any attempt to accomplish this for AM and FM broadcasters would be significantly more difficult due to the existence of more than 12,000 licensed radio stations. Moreover, the regulatory proceedings associated with any such allotment process would

impose a significant burden on the thousands of family-owned and independent broadcasters that would be affected.

C. A New Spectrum Approach Would Have a Negative Commercial Impact

Any attempt to transition current broadcasters to new spectrum has the potential to impact the valuation of existing stations. Existing stations do not have uniform coverage in any markets. Coverage is a factor of the site of the station's transmitter, the height of the transmitter, the power of the transmission and surrounding terrain. A particular station's coverage may significantly impact the economic valuation of that station when compared to other stations in the same market. Any movement of stations to new spectrum inevitably will result in changes to coverage areas of some stations, which will in turn have an impact on station valuations. Broadcaster concern about these changes may add to the administrative burdens of crafting a plan for a transition to new spectrum and may diminish broadcaster enthusiasm for DAB. The result would be to slow or foreclose the implementation of DAB.

D. New Spectrum Would Lead to Consumer Confusion

Relocation of existing broadcasters in new spectrum would require that listeners change their behavior. Listeners would need to find the new dial positions of their favorite stations and would not be able to scan stations in their current order. Because listeners frequently identify stations not by call signs but by frequency designations of dial position, relocation could cause significant confusion. Although these issues have been addressed in HDTV equipment, the sheer number of radio stations involved and the capacity which would be required to cross reference between old and new dial positions make it unlikely that IBOC receivers would be able to present a seamless transition to new spectrum.

E. Any Attempt to Use TV Channel 6 Would Be Particularly Problematic

The Commission's proposal to use TV Channel 6 would lead to significant delays, if not a total failure, in efforts to implement DAB. As the Commission itself notes, the Channel 6 spectrum does not become available until 2007.[24] Moreover, this date assumes the transition to digital television has been completed and that incumbent television broadcasters have vacated the spectrum.[25] Based on the current state of DTV implementation, one cannot assume Channel 6 spectrum will be widely available by 2007. For DAB, partial availability would not be sufficient to facilitate implementation. Radio is most often used in a mobile environment. If the spectrum designated for DAB were not available in certain markets, it is unlikely that consumers, receiver manufacturers or automobile manufacturers responsible for placing radios in cars would make the necessary investment in DAB.

F. The IBOC Approach Avoids These Liabilities

Because IBOC DAB offers an in-band solution, it avoids all the liabilities associated with a new spectrum approach. IBOC will allow all terrestrial broadcasters to upgrade to digital without the disruptions associated with transitions to new spectrum. All broadcasters will retain their existing coverage patterns and dial position. Consumer confusion will be minimized because consumers will be able to find their favorite stations at their current dial positions. Because IBOC can be implemented in the course of normal equipment replacement cycles, upgrade costs are minimized. Moreover, there will be no need for the Commission to expend resources licensing new stations. In summary IBOC will provide an efficient and effective means of implementing DAB without disruptions for the public.

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[24] Notice at 17.

[25] *Id.*

VII. The Commission Should Set an IBOC Standard

USADR supports the tentative conclusion in the Notice that the Commission should be involved in the establishment of an IBOC transmission standard. USADR also urges the Commission to recognize both prongs of its test for mandating a standard are satisfied in this case. Recognizing the need for a transmission standard and establishing procedures for developing that standard at this point will help ensure a timely introduction of DAB.

There would be substantial public benefit from an IBOC transmission standard. Most importantly, a standard would preserve the ubiquitous nature of radio by ensuring compatibility between transmission and reception of broadcast radio signals. A standard also will ensure the various players necessary to complete DAB (broadcasters; transmitter, receiver, and semiconductor manufacturers; and listeners) do not hesitate to invest in IBOC for fear of being stranded with unusable technology.[26]

In the Notice the Commission questions whether the nature of IBOC technology would lead to compatibility or would favor a designated standard. USADR believes the IBOC systems are highly incompatible, and interoperability will not occur without a standard. The basic core components of the systems, such as the audio codec and the coding schemes, are incompatible. If a listener had an IBOC receiver with a codec other than AAC, that receiver would not be able to decode the signal from a station using the USADR system. USADR is not aware of any mechanism to make the systems compatible, other than multimode receivers which USADR believes would be an unacceptable means to achieve compatibility. In addition to increasing costs substantially, a multimode receiver would increase the size and weight of the unit, power consumption and the

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[26] For a more detailed discussion of the public benefits of a standard, *see* Petition for Rulemaking of USADR, RM-9395 (Oct. 7, 1998) at 92 and Appendix B.

acquisition time of the digital signal.[27] Thus, broadcasters and consumers would be forced to choose between systems. Finally, the Commission should be aware the IBOC system may not use standard off-the-shelf DSPs but rather may need to use more customized DSPs or even Application Specific Integrated Circuits ("ASICs") that ensure lowest costs for consumers. This would greatly complicate any effort to make systems compatible.

USADR believes it is unlikely a consensus on a standard will appear without Commission action. There are too many necessary participants to reach an acceptable agreement on a *de facto* standard. As Chairman Kennard recently noted in the context of DTV, where there are many industries involved, each with competing agendas and incentives, reaching a consensus is difficult.[28] USADR agrees with Chairman Kennard that where the market cannot sort through the issues, the Commission must act.[29] DAB presents exactly the same requirements for Commission action in order to avoid a stalemate between different components of the industry.

VIII. The Commission Should Establish A Process For Setting A Standard

The Commission should establish a process for collecting additional information to set a standard for IBOC by the end of this year. Prompt development of a process will allow IBOC proponents to structure their system development efforts and test programs to provide the Commission with the most useful information.

As was noted above, USADR recently submitted to the NRSC an initial report on laboratory and field testing of its system. USADR is moving forward with its system and has contracted with the ATTC to perform a full, independent test and validation of the USADR system. USADR expects

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27 Size, weight and power consumption are particularly important issues for portable radios.

28 *See* "IPTV: From the Vast Wasteland to the Vast Wonderland," address by William E. Kennard to the Consumer Electronics Show dated Jan. 7, 2000 at 4.

those results to be available by mid-year. USADR urges the Commission to establish a process for collection of data using the following timeline:

- June 1, 2000 — FCC Adopts R&O establishing IBOC as means to implement DAB, adopts evaluation criteria, issues call for submission of system and test data and releases Further Notice on implementation issues.
- September 1, 2000 — Deadline for proponents to submit system descriptions and test results to Commission.
- December 31, 2000 — FCC adopts Second R&O designating IBOC transmission standard

The September 1, 2000 submission should include a full system description of the final IBOC system and a report of comprehensive laboratory and field testing by a qualified independent entity. USADR encourages the Commission to endorse use of the existing NRSC guidelines for these tests.

USADR recognizes the NRSC should have a continuing role in this process. USADR intends to use the NRSC's existing test guidelines and welcomes further input from the NRSC on any changes to those guidelines which may be appropriate for USADR's next round of tests. USADR also believes the NRSC can play an important role collecting and analyzing the technical data on IBOC testing. Ultimately, however, only the Commission will have the broader view and the necessary authority to establish an IBOC standard taking into account the technical, regulatory and commercial interests at stake.

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[29] *Id.* at 5.

IX. Conclusion

USADR applauds the Commission's steps to move forward toward DAB implementation. USADR urges the Commission (i) to use this opportunity to designate IBOC as the means to implement DAB in the United States; (ii) to make a determination that the Commission will need to designate an IBOC transmission standard and (iii) to establish a process for collecting the necessary test data to designate an IBOC standard by the end of this year.

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